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INFECTIOUS DISEASES AS A CAUSE OF LOSS IN WILDLIFE

By J. E. Shillinger, Senior Veterinarian, In Charge, Disease Control
Division of Wildlife Research

During the last few years the growing interest in our wildlife resources and the increasing recognition of the value of game as a source of recreation in this country have led to demands upon conservation officials for better protection of the various species. These demands have pertained not only to modifications in hunting regulations but also to studies of wildlife ailments and the institution of measures for their control where feasible. When activities in the study of wildlife diseases were begun by the Bureau of Biological Survey, it was found that this relatively new field of research had had the attention of very few responsible investigators, none of whom had made it a matter of primary interest. In the past such studies had been made almost invariably because of some recognized connection between the diseases of wild forms and the welfare of human beings or of domestic livestock, and not for the sake of the wildlife itself. The literature in this field is therefore meager and widely scattered.

Certain forms of game are known to pass through cycles of abundance and scarcity, irrespective of hunting activities, food supply, or weather conditions. Biologists have considered the various destructive agencies that may be involved with these cyclic, or periodic, decreases of game, but thus far no one factor appears to fit so adequately into the picture as does disease. The game species usually mentioned in references to disease are rabbits and grouse. Certain carnivorous fur animals also exhibit periodicity in abundance, but increase and decrease in these groups seem to parallel those of their natural food supply, which is composed largely of the game species mentioned.

A study of the population records during a complete cycle shows a gradual rise in numbers, with an acceleration near the peak. After one or more years of great abundance some obscure condition enters the picture and causes a precipitous decline. The losses have never been adequately studied. In fact the mortality is seldom recognized until after the peak of losses has passed. Because of the tendency of sick wild subjects to secrete themselves in secluded hiding places and because of the rapidity with which small mammal and bird carcasses become disintegrated by natural elements or are removed by scavengers, such losses are seldom noted by the casual observer.

In the last few years, during which studies have been conducted by the Biological Survey and cooperating organizations, those forms of wildlife subject

to cyclic disappearance have in general been on the increase. For purposes of making the information as comprehensive as possible, the cooperating agencies have taken monthly samplings of cottontail rabbits and snowshoe hares of a typical game region on an area of 6 square miles in central Minnesota. During the fall in several successive years grouse samples also were collected at large in Minnesota, Wisconsin, and Michigan. The specimens were first examined physically and the external parasites collected. Gross examinations were then made of the organs, and the internal parasites were studied. Suspicious organs were cultured, and the liver, spleen, and muscle tissue of all suitable specimens were injected into test animals. Ticks and fleas collected were used for injection after grinding and filtering, and free ticks were collected from vegetation and injected into test animals (1, 2,).

Since these investigations have been in progress, the cottontail rabbits have reached their peak of density, and a pronounced decline has taken place on the study area now under daily observation. Careful search by specially trained men assisted by dogs revealed many cottontail rabbits sick and dead. Gross appearances, agglutination tests, and cultures derived from both tissues and external parasites when passed through test animals revealed the presence of tularemia as a constant infection in these animals and demonstrated that this disease was undoubtedly the cause of the widespread loss in that region. Paralleling the observations in Minnesota, a similar wiping out of cottontail rabbits by tularemia in more or less circumscribed areas has also been observed in other parts of the country.

From these results it was assumed that there was in sight the solution of the problem of cyclic disappearance of both snowshoe hares and grouse, since the two live in the same environment, are parasitized by the same species of ticks, and are in every way closely associated. This view has, however, not as yet been substantiated. Several thousand snowshoe hares have been live-trapped and identified with metal ear tags. During the past 2 years there has been noted a very high tick population on the detailed-study area. While the snowshoe hares and grouse have actually increased in numbers, the average number of ticks per animal has also multiplied. For several consecutive months during the warm weather the average tick population per snowshoe hare was over 2,000. On large numbers of specimens it was not unusual to find as many as 5,000 ticks per animal, and in some instances actual count has revealed as many as 10,000. In the same areas from which the cottontail rabbits disappeared, hares and grouse have maintained their numbers or even increased. Both have been found susceptible to tularemia infection through the previously mentioned processes of tissue and parasite inoculations and agglutination tests. It is apparent that they may be carriers of the infection without its causing serious inroads on their numbers. Human infections have occurred from handling apparently healthy grouse. The incidence of tularemia infection, however, in ticks taken from grouse and snowshoe hares and in ticks found free on the local vegetation has decreased since the cyclic disappearance of cottontail rabbits in the area, despite the abundance of hares and grouse. Comparison of the strains of Pasteurella tularense taken from game species shows that the organisms vary in their virulence and infectivity and that some strains require a much longer incubation period than others.

Evidence of the susceptibility of a wide variety of wild forms to tularemia has been established by the examination of sick and dead specimens and of human infections from contact with these forms, and also by laboratory tests. In the light of observations thus far made, it appears possible that not only cottontail rabbits but also muskrats and gray foxes may be killed off by tularemia. The coincident infection of domestic livestock with this disease, acquired from close association with wildlife undergoing decimation from it, was demonstrated in 1934 by local authorities in Montana through agglutination tests and recovery of the organism. Several hundred sheep died from the infection a few weeks after being placed on a range where the mortality among jack rabbits had been heavy. Ticks of identical species were found in great numbers on both the sheep and the jack rabbits.

Based on information at hand, it must be concluded that although tularemia is responsible for the disappearance of cottontail rabbits, and possibly other species, it cannot be stated at this time that this disease accounts for the periodicity of populations of snowshoe hares and grouse in the North Central States (3). It is evident, therefore, that some more virulent strain of Pasteurella tularense, or some other disease or diseases, must be the cause of the wiping out of these species.

The processes described by which examinations are being made of great numbers of wild specimens are expected to reveal any infectious disease that makes its appearance in epizootic form. Up to the present, tularemia, pseudotuberculosis, and ulcerative enteritis are the diseases recognized as holding the greatest potential responsibility for the periodic disappearance of small game. Pseudotuberculosis as yet has been observed only in comparatively few subjects.

During the fall of 1933, ulcerative enteritis, a commonly encountered disease of quail, was observed in grouse (4) in Minnesota, and studies are now in progress to learn to what extent this infection may account for the decimation of these birds. While the specific etiology of this disease (5, 6) is not definitely known, its identity as a nonfiltrable organism living in the enteric canal has been demonstrated. Its destructiveness among quail and grouse is well established. Further studies are required to learn to what extent it is the cause of deaths in other species over the areas where periodic losses are pronounced.

Blackhead likewise has frequently been found to be highly infectious in quail and wild turkeys, and in these species the mortality, when infection occurs, is high. Like aspergillosis, this disease appears to cause the greatest losses in restricted preserves with dense population, but until more comprehensive studies are made, it will not be known just how frequently this disease may account for the widespread losses on uncontrolled premises.

It has not been the purpose of these studies in periodicity to learn how many different diseases may attack the various wild species. The most active investigations are devoted to learning to what extent the periodic decimation of game is chargeable to infectious disease and, if the present appearances

prove to be correct, what diseases are responsible and what means of control or prevention can be employed. These findings, therefore, should be considered only as a summation of the preliminary work in a study of a long-time problem, one that calls for a great mass of information, which can be procured only over a period of consecutive years and through at least one complete cycle.

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